REMARKS

Claims 8–11, 16–19, 24–27, 32–35, 40 and 41 are pending in this application. By this Amendment, claim 8 is amended to further distinguish over the reference cited in the Office Action and is supported by Examples 1 and 2 of the present specification. Claim 41 is added to establish a range of time for heat treatment and is supported by page 22, lines 7-12 and page 23, lines 9-14 of the present specification. No new matter is added by this Amendment.

I. Rejection Under 35 U.S.C. §103(a)

Claims 8-11, 16-19, 24-27, 32-35 and 40 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over U.S. Patent No. 6,372,609 ("Aga"). This rejection is respectfully traversed.

A. Aga Fails to Teach or Suggest the "Identical Processing Method" Recited in the Present Claims

The Patent Office acknowledges that Aga does not specifically disclose that the thickness of the buried oxide film is reduced to 100 nm or less by heat treatment. The Patent Office asserts that the present claims are *prima facie* obvious, allegedly because Aga describes "the identical processing method as instantly claimed." Applicants respectfully disagree.

Aga discloses a method of producing an SOI wafer, wherein a base wafer 1 and a bond wafer 2 are prepared (step A); an oxide film 3 is formed on the surface of the bond wafer 2 (step B); the base wafer 1 is superposed on the bond wafer 2 via the oxide film (step D); a delamination wafer 5 is delaminated from an SOI wafer 6 (step E); and a bonding heat treatment is performed so that the bonding between the wafers of the SOI wafer 6 is further strengthened (step F). See Aga, col. 5, line 50 – col. 6, line 33.

Claim 8, on the other hand, is directed to a process for producing an SOI wafer having a buried oxide film with a thickness of 100 nm or less by:

(1) forming an oxide film having a total thickness of 100 nm or more,

(2) bonding a bond wafer and a base wafer together,

(3) forming the bond wafer into a thin film, and

(4) heat treating the buried oxide film until a time when the thickness of the buried oxide film is reduced by 20 nm or more. By this method, an SOI wafer having a buried oxide film with a thickness of 100 nm or less can be made to have good crystallinity and reduced occurrences of blisters and voids. See pg. 6, line 25 to pg. 7, line 16 of the present specification.

Aga does not teach or suggest the identical processing method recited in claim 8. Specifically, Aga fails to teach or suggest applying an oxide film having a total thickness of 100 nm or more that is greater than the thickness of the buried oxide film to be produced (i.e., less than 100 nm), and fails to teach or suggest a heat treatment that reduces the thickness of the buried oxide film by 20 nm or more.

For all the foregoing reasons, producing an SOI wafer according to the recited method of claim 8 is clearly different than the method of Aga, which discloses producing an SOI wafer by a different method and wherein the thickness of the buried oxide layer is thick (such as 700 nm in the Aga Example). Thus, Applicants assert that the present claims are not *prima facie* obvious, as the present claims include elements (heat treatment of a buried oxide film with a thickness of 100 nm or more to reduce the thickness of the buried oxide film by 20 nm or more to be less than 100 nm) not found within the prior art.

B. Unexpected Results Demonstrated in Rule 1.132 Declaration

Furthermore, the Patent Office alleges that the evidence submitted in the Rule 1.132 Declaration ("the Declaration") submitted on July 31, 2007 was insufficient to overcome the rejection because (1) the details for heat treatment (i.e., atmospheres, temperature range, and time for heat treatment) are not allegedly included in claim 8, (2) the results presented in

Table 1 of the Declaration allegedly indicate that the method taught by Aga sufficiently achieves a thinning of the oxide film from a thickness of 100 nm to a thickness less than 100 nm, (3) "Applicants' arguments regarding the generation of blisters and voids" are allegedly not in accordance with the presently claimed subject matter and (4) the Remarks submitted in the July 31, 2007, response allegedly poorly explain the Rule 1.132 Declaration. Applicants respectfully disagree.

1. Details of Heat Treatment

The Patent Office alleges that the details for heat treatment (i.e., atmospheres, temperature range, and time for heat treatment) are allegedly not included in claim 8. Furthermore, in the May 31, 2007 interview, Examiner Rodgers suggested amending claim 8 to incorporate a range of time for the heat treatment of the buried oxide film.

Applicants have amended claim 8 to recite that the heat treatment is sustained until the thickness of the buried oxide film is reduced by 20 nm or more. The amount of thickness the buried oxide film is reduced varies with the thickness of the SOI layer. See page 18, lines 12-22 and Figure 4 of the present specification. Accordingly, it is necessary for the heat treatment to reduce the thickness of the buried oxide film to be performed until the time when the desired thickness of the buried oxide film is achieved. The amended claim 8 thus specifies heat treating the buried oxide film until a time when the thickness of the buried oxide film is reduced by 20 nm or more in order to specify the heat treatment requirements, as suggested by the Examiner. For completeness, dependent claim 41 has been added to broadly specify a heat treatment time.

2. Aga Does Not Indicate a Thinning of an Oxide Film From a Thickness of 100 nm to a Thickness of Less Than 100 nm

The Patent Office alleges that the results presented in Table 1 of the Declaration allegedly indicate that the method taught by Aga sufficiently achieves a thinning of the oxide film from a thickness of 100 nm to a thickness less than 100 nm. Applicants disagree.

Aga discloses a method comprising forming an oxide film having a thickness of about 0.1 μm–2.0 μm (100 – 2000 nm) on the surface of a bonded wafer (*see* Aga, col. 5, lines 57-60) and being further subjected to (bonding) heat treatment performed in an inert gas atmosphere by Rapid Thermal Annealing (RTA) at a temperature of 1000-1300 °C for 30 minutes to 2 hours (*see* Aga, col. 3, line 66 – col. 4, line 4 and col. 6, lines 31-33).

However, Aga does not disclose or suggest that heat treatment can reduce the thickness of the buried oxide film by 20 nm or more. Furthermore, as stated above, Aga does not disclose or suggest heat treating the buried oxide film until the thickness of the buried oxide film is reduced 20 nm or more.

The bonding heat treatment of Aga at best only makes it possible to slightly reduce the thickness of the buried oxide film. However, the Rapid Thermal Annealing of Aga cannot reduce the thickness of the buried film by 20 nm or more. This is confirmed by the thickness and heat treatment conditions of Aga when viewed in conjunction with Figure 4 of the present specification.

Figure 4 of the present specification compares the "Thickness of the SOI Layer" to the "Reduction Amount of Thickness of a Buried Oxide Film" for an SOI layer heat treated at 1200 °C for 1 or 4 hours, respectively.

Aga discloses an example in which the thickness of the buried oxide film is 700 nm (see Aga Example, col. 9, lines 56-57) and further discloses heat treatment for 2.5 hours at a temperature of 900 °C. See Aga, col. 10, lines 36-37. As shown in Figure 4 of the present

specification, even if the 700 nm buried oxide film of Aga were subjected to a thermal treatment of 1200°C for 4 hours (more than the 2.5 hour max taught in Aga), the reduction in thickness of the buried oxide film would be less than 12 nm.

Thus, even if the SOI layer of Aga is subjected to heat treatment in an argon gas atmosphere at 1200 °C for two hours, the thickness of the buried oxide film is not reduced by any more than about 12 nm at most, and thus Aga does not teach reducing the thickness by 20 nm or more as presently recited in claim 8. Thus, Aga fails to teach or suggest all of the requirements recited in claim 8 and therefore, Aga does not render the present claims obvious.

The bonding heat treatment disclosed in Aga cannot reduce the thickness of a buried oxide film 20 nm or more. Thus, it would not have been obvious to one of ordinary skill in the art to have reduced the thickness of the buried oxide film by 20 nm or more to achieve a buried oxide film with a thickness of 100 nm or less as recited in claim 8.

C. Generation of Blisters and Voids

The Patent Office alleged that "[a]pplicants' arguments regarding the generation of blisters and voids" are not in accordance with the presently claimed subject matter. Applicants respectfully disagree.

The generation of voids and blisters does not depend on the method used to make the bond wafer thinner, but depends on the actual thickness of the bond wafer. Specifically, if an SOI wafer having a buried oxide film with a thickness of 100 nm or less is produced using delamination heat treatment prior to bonding heat treatment, blisters and voids tend to be generated by the release of gases (degassing). The blisters and voids are a result of the small buried oxide film because as the buried oxide film becomes small, the volume of gas that can be adsorbed by the buried oxide film is reduced. See paragraphs [0033]-[0034] of the specification and Aga, col. 6, lines 8-23 and Figure 1.

Even if an SOI wafer having a buried oxide film with a thickness of less than 100 nm is produced in the method described in Aga, the problem that blisters and voids tend to be generated in delaminating heat treatment after bonding of the wafers still occurs. The problem of blisters and voids still occurs because RTA is used in the bonding heat treatment of Aga. Even if the bonding heat treatment is performed for such a short period of time, the reduction amount of the thickness of the buried oxide film is extremely small and would fail to reduce the thickness of the buried oxide film from 100 nm or more (thickness of the formed oxide film) to less than 100 nm and by at least 20 nm.

On the contrary, the heat treatment to reduce the thickness of the buried oxide film by at least 20 nm, as required in claim 8, is performed at a temperature and for a time sufficient to reduce the thickness of a 100 nm or more buried oxide film by 20 nm or more to be less than 100 nm. Thus, the bonding heat treatment of Aga is not the same as or even substantially similar to the heat treatment for reducing the thickness of the buried oxide film by at least 20 nm as recited in claim 8.

The Rule 1.132 Declaration ("the Declaration") submitted on July 31, 2007, details that SOI wafers produced by the recited method of the present claims (in which a buried oxide film is formed with a thickness of 100 nm or more and then the buried oxide film thickness is reduced by 20 nm or more to less than 100 nm by heat treatment) achieve unexpected results in substantially avoiding voids and blisters when compared to SOI wafers produced by a method in which an oxide film is formed with a thickness of less than 100 nm and heat treated under similar conditions. As the Declaration (1) illustrates the method recited in claim 8 and (2) is commensurate with the scope of the claims, the evidence submitted in the Declaration confirms that unexpected results in substantially avoiding voids and blisters on an SOI wafer are achieved by the claimed method.

D. Supplemental Remarks for Rule 1.132 Declaration

The Patent Office alleges the Remarks submitted in the July 31, 2007, response do not adequately explain the Rule 1.132 Declaration ("the Declaration"). Although Applicants disagree with the Patent Office's conclusion, Applicants hereby supplement the explanation of the Remarks.

First, the Patent Office alleged that Example 1 in Table 1 of the Declaration is in line with the teachings of Aga. Example 1 in Table 1 of the Declaration does not correspond to Aga, but corresponds to amended claim 8 of the present application because the heat treatment in Aga is conducted for only 2 hours (see Aga, col. 6, lines 31-33) whereas Example 1 in Table 1 was conducted at 1200 °C for 4 hours. Accordingly, Example 1 in Table 1 of the Declaration corresponds to the method of amended claim 8 of the present application, not Aga.

Second, the Patent Office alleged that Example 2 of Table 1 of the Declaration is in line with the teachings of the specification, but not with the instant claims. Example 2 describes the formation of a 30 nm buried oxide film in an SOI wafer as the final product from a larger 100 nm buried oxide film starting material. After heat treatment is performed, the thickness of the buried oxide film is reduced by 70 nm to form a 30 nm buried oxide film with little formation of voids and blisters. Accordingly, Example 2 in Table 1 of the Declaration is commensurate in scope with the claims because the thickness of the buried oxide film is reduced by 20 nm or more.

Finally, the Patent Office alleged that it is unclear what Comparative Examples 1', 2', 1" and 2" are intended to display. Comparative Examples 1', 2', 1" and 2" were included in the Declaration according to the Examiner's request during the May 31, 2007, interview. During the interview, the Examiner alleged that Table 1 of the present specification fails to show unexpected results because Comparative Examples 1 and 2 were not subjected to the

same heat treatment as Example 1 and 2. Thus, Applicants included these additional Comparative Examples in the Declaration to confirm that unexpected results occur when Comparative Examples 1 and 2 were subjected to the same heat treatments as Examples 1 and 2 in the specification.

Thus, Examples 1 and 2 illustrate that voids or blisters are not substantially formed if a buried oxide film with a thickness of 100 nm or more is heat treated at 1200 °C for 4 hours or 14 hours, respectively. However, Comparative Examples 1', 2', 1" and 2" illustrate that voids or blisters are significantly formed if a buried oxide film with a thickness is less than 100 nm (80 nm and 30 nm, respectively) is heat treated at the conditions as Examples 1 and 2.

Thus, Comparative Examples 1', 2', 1" and 2" further illustrate that the method recited in claim 8 achieves unexpected results. Thus, the Patent Office's allegation that the claimed range of thickness is *prima facie* obvious is rebutted by the evidence of unexpected results submitted in the Declaration and further clarified herein.

E. Conclusion

Because the features of independent claim 8 are not taught or suggested by Aga, Aga would not have rendered the features of claim 8 obvious to one of ordinary skill in the art. Furthermore, the allegation by the Patent Office that the claimed range of thicknesses for the buried oxide film is *prima facie* obvious is incorrect, and is further rebutted by evidence of unexpected results illustrated in the Declaration. Thus, reconsideration and withdrawal of the rejection under 35 U.S.C. §103(a) are respectfully requested.

II. Conclusion

In view of the foregoing, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of claims 8–11, 16–19, 24–27, 32–35, 40 and 41 are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

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Date: February 13, 2008

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